THE

DISINFECTANT QUESTION:

REVIEW OF A BOOK

BY DR. R. ANGUS SMITH,

ENTITLED

Disinfectants and Disinfection.

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THE

DISINFECTANT QUESTION.*

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Some twenty years ago there prevailed, among the educated classes, much scepticism as to the spread of disease by contagion, with almost equal incredulity respecting the phenomena of infection. The natural consequence of these opinions was, that the belief in the utility of disinfectants for preventing and controlling contagious and infectious diseases had all but died out. In the reaction which has since taken place in favour of the older doctrines on those subjects, Dr. Angus Smith, of Manchester, has played a very prominent part. His labours and writings have contributed, in no small degree, towards the remarkable re-awakening of the public mind to the reality of infection, and the practical importance of disinfectants which the present generation has witnessed, and to which the recent visitations of cattle plague and cholera have powerfully contributed.

Unfortunately, however, Dr. Smith, at an early period of his researches, invented a disinfecting compound, and, in conjunction with a manufacturing chemist of the name of McDougall, took out a patent for it. This product has since become known by the name of McDougall's Powder. Its activity is described as depending on the presence of sulphurous and carbolic acids in the shape of sulphite and carbolate of lime and magnesia, which, theoretically, are supposed to exist in a state sufficiently free and in quantity enough to secure very energetic action. But the actual composition of the compound is found by analysis to be a vastly preponderating basis of simple

* Disinfectants and Disinfection, by R. Angus Smith, Ph.D., F.R.S. F.C.S.—Edmonston and Douglas.

lime, associated with about that proportion of magnesia which occurs in many natural lime-stones, and holding in combination, in the form of insoluble sulphite of lime, a certain modicum of sulphurous acid, the whole being impregnated with a very moderate dose of carbolic acid.* Both of the ingredients on which its efficacy is said to depend, namely, carbolic and sulphurous acids, have been universally classed by chemists among antiseptic or preserving substances, as distinguished from oxidizing or destructive disinfectants. Dr. Smith does not demur to this description of them, nor does he contest the soundness of the principles on which the *modus operandi* of antiseptics and disinfectants proper is usually explained. It is to be feared, however, that the position in which he stands to carbolic and sulphurous acids, by reason of his invention, has caused him to allow himself to be betrayed into disregarding the distinction between those two classes of substances, and treating of them as if they were identical in their effects.

We cannot help suspecting that it is under the influence of this circumstance that Dr. Smith writes—"They are clearly one in principle. We cannot separate these two in taking a survey of the subject as it stands (p. 1)." Yet, the result is, that common salt and chlorine are by him placed in the same category. Both, according to our author, are disinfectants—salt, which when applied, to tainted meat, preserves it from further rapid decomposition but shuts up undiminished the existing taint, forming a putrid pickle, as well as chlorine, which effectually frees meat from taint, but cannot, in the smallest degree, help to preserve or pickle it. Can it be doubted that, but for Dr. Smith's prepossession in favour of antiseptics, so intelligent an observer in other respects would have seen the error and disadvantage of classing together such substances? It is evident, therefore, that some degree of taint runs through the whole of his treatise, and that his statements respecting the comparative utility of antiseptic

* This does not differ very materially from the composition of "gas lime." The chief difference is that the principal tar product in gas lime is naphthaline and not carbolic acid. But there is reason to think that both of these products possess much the same properties as antiseptics.

and oxidizing disinfectants must be received *cum grano salis*. Passages, nevertheless, here and there occur in his book, wherein peeps out a just apprehension of the truth. "In ancient times," we read (p. 8), "the prevention of corruption was more studied than actual disinfection. Bodies preventing corruption are properly antiseptics." And again (p. 38), "Oxides, as a rule, are disinfectants,—that is, removers of smell, deodorizers, and destroyers of decaying matter, but not preservers of substances or antiseptics." But in the sequel the exigencies of his thesis force him to suppress his better knowledge.

In the chapter on chlorine, we have evidence that Dr. Smith is well acquainted with the power of that element to destroy putrid and morbid products. "Chlorine," he writes, "is a great disinfectant, probably the most powerful agent for the destruction of organic structure, whether healthy or unhealthy. The latter is always most easily destroyed, as it is weak, and putrefying matter still more so, as it is already breaking up; and herein lies our protection; we may use just enough to destroy the decaying, but not to injure the sound. In passing through bleach-works, we may often have occasion to remark the ruddy, healthy faces of the men employed. This is, no doubt, due to the slight and constant smell of chlorine." On reading this, and comparing it with all that even Dr. Smith can say in recommendation of his favourite antiseptics, it might be supposed that he was about to admit chlorine to be the very agent which is generally wanted as a disinfecting safeguard against morbid products, the destruction of which and not their preservation is what is required. But no, nothing of the sort; for chlorine, wonderful to relate, has the drawback of destroying instead of preserving manures! (p. 49). That is to say: If a certain quantity of manure were treated with an equal quantity of chloride of lime, which would be an absurd proceeding, the former would be destroyed; whereas, if manure were treated with only sufficient chloride of lime to render it inoffensive, which would be the proceeding of a reasonable man, its fertilizing value would not to any appreciable extent be diminished. Surely, this only goes to prove

the utility of chloride of lime in the hands of any rational person. But what has manure to do, except in the remotest manner, with the question of the choice of disinfectants for the occasions wherein, nine times out of ten, they are required, namely, the combating of disease? Besides, we have already been told by our author that chlorine seizes by preference on the less sound portions of decaying matter such as manure, and leaves comparatively untouched the more sound. The bias under which the closing part of the last-cited passage has been dictated will be more apparent when it is known that the application to manure of the compound specially recommended by Dr. Smith, namely, McDougall's Powder, owing to its being composed largely of common lime, has the effect of rapidly liberating the ammonia, which is one of the most valuable constituents of manures. Without the knowledge which he may be supposed to possess of the composition of that powder, he might have learnt this fact from his own experiments, wherein it is shown (p. 97) that, when mixed with human excrement, its principal sensible effect was the copious evolution of ammonia, accompanied with sulphuretted hydrogen.

Evidences of inability to hold the scales on even balance abound throughout the book. In the chapter on the tar acids, occasion is taken to narrate at great length the proceedings instituted by Mr. Crookes at the time of the cattle plague, for the purpose of displaying the effects of carbolic acid; but no allusion whatever is made there or elsewhere to the much more extensive operations carried out with chlorine by the county police of Lancashire, under the direction of Professor Stone, of Manchester, although the attention of the Cattle Plague Commission, and of our author, who from the first acted in the capacity of their chemical adviser, was specially directed to them. Nor is there to be met with so much as a single mention of the extremely valuable observations recorded and tabulated by Dr. Ballard, of Islington, showing the progress of the cattle plague among the cow-houses of his extensive district, and the results of disinfection and other sanitary measures. Whereas the official Report on Disinfectants made by Mr. Crookes to

the Cattle Plague Commission gives an account of only nine practical experiments, some of which amount to no more than this,—that carbolic acid was used on farms where cattle plague had not come, and no cases of the disease appeared between the time of the trial and that of the report; the returns of Dr. Ballard extend to fifty-three cow-houses wherein the plague had broken out, and comprise an accurate record of the conditions in respect to crowding, cleanliness, and disinfection, under which the disease re-appeared or not in the infected sheds among the cows purchased to replace those that had died. Compared with Dr. Ballard's observations those of Mr. Crookes are of very little value indeed, not only on account of their limited number, the hurried way in which they were made, and the inexperience of the observer in the kind of work, but also on account of the unsystematic manner in which they are recorded. To give an idea of the valuable nature of the information contained in Dr. Ballard's tables, as printed in the Appendix to the Second Report of the Cattle Plague Commission (p. 7,) we subjoin two of his most instructive entries.*

In the same way that, after apparently stating with fairness the properties of chlorine, he gives it a back-handed blow as being destructive to manure, so Dr. Smith takes care, while in appearance doing justice to another valuable disinfectant of the oxidizing class, namely, Condy's Fluid (permanganate solution), to

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	Dennison, Swan Yard.	Garland and Hoyte.
*Condition of sheds	good	bad
Number of cows usually kept	20	25
Cubic space in sheds per cow	580	300
Dung-pit within shed or not	not	not
Number of cases of plague up to date of return	20	6
Died, or slaughtered on appearance of plague	20	5
Number of cows in sheds at date of return	7	13
Brought in since outbreak	7	12
Shed ever quite empty of cows, or not	not	not
Disinfectants used	Chlorine and Condy's Fluid	Condy's Fluid & Stockholm tar
Cases of plague since habitual use of disinfectants	none	none

deal it also a similar blow on the score of its pretended costliness. "Manganese," he says (p. 37), "condenses oxygen, forming permanganate of potash, a substance beautiful in colour and innocent in character, whilst it oxydizes powerfully all the foulest bodies, and removes the most putrid odours as if by magic. We have to thank Mr. Condy for teaching us its use. It is certainly an elegant disinfectant, a name which it bears in opposition to antiseptic, which it is not, as it does not preserve." But this eulogistic language is followed by the blow and discouragement in the shape of a statement which, if true, would, so far as practical use goes, render the eulogy entirely nugatory. "In cow-houses, and even in families, these two substances (peroxide of hydrogen and Condy's Fluid), are expensive." And, again (p. 129), "For disinfection, when putrefaction has advanced, and the smell is to be removed, there is, perhaps, nothing superior or even equal to chloride of lime, unless we except peroxide of hydrogen and permanganate of potash (Condy's Fluid), which are expensive." Condy's Fluid, a thoroughly popularized preparation, put, in the matter of price, along with peroxide of hydrogen, which is still a chemical curiosity! It so happens, however, that this statement, regarding the expense of disinfecting by Condy's Fluid, is utterly erroneous. The very contrary is the case. When compared with the substance of Dr. Smith's predilection,—namely, carbolic acid, this preparation will be found, without reference to comparative efficacy, to cost only one fourth as much. The contrast based on the prices and directions, which are given on Condy's label, and that of Calvert, one of the best makers of carbolic acid, stands thus:—

	Price.	Quantity produced when diluted for use	Cost of dilution
Condy's Fluid	1s.. per pint	80 quarts	½d. p. gal.
Calvert's carbolic acid	1s. 6d. per lb.	20 quarts	3d. p. gal.

When carbolic acid, free of any vehicle, compares so disadvantageously, as to cost, with Condy's Fluid, how much more disadvantageously must it contrast with that substance, when compounded in small proportion with a large amount of foreign matter, the

carriage and storage of which entail useless outlay. And when all is paid for, what are the results obtainable, in some important cases, from the latter preparation? Let the answer be given from Dr. Smith's book. In a table, at page 109, showing the effects of gases, &c., on flesh, we read: [State of the flesh after seven days' exposure.] "McDougall's Powder, putrid and slimy;" and immediately afterwards, as if by way of apology for having been so foolish as to expect better results, "McDougall's Powder was tried here simply to see if it gave off carbolic acid enough to prevent putrefaction of meat; it was found *not to do so*;" whereas, in the same experiment, the flesh exposed to chlorine gas, at the end of twenty-eight days, was pronounced to be "unchanged, red inside, bleached on the surface." Nevertheless, this is the preparation which Dr. Smith has so long and so confidently recommended in preference to chlorine, the use of which he discourages in a special paragraph wherein we find (p. 50):—"*Evils. Dangers of excess in fumigation.*—A slightly unpleasant smell afterwards. Strong fumigation may be used, but no one must breathe the fumes. When strong, very dangerous." There is no risk, certainly, of McDougall's Powder proving dangerous from the strength of its exhalations; but, as to unpleasant smell, we should say that was its most remarkable property.

In the chapter entitled "Deodorization," our author gives three tables intended to exhibit the relative value of different disinfectants for removing smells. These, like much of the rest of the volume, are reprinted from the Third Report of the Cattle Plague Commission. None of the substances set out in them, carbolic acid included, proved satisfactory; but in a note appended to the third table we learn that "permanganate of potash or Condy's Fluid completely removes the smell at once." Nevertheless, Dr. Smith, in the very next sentence, ignoring the results obtained with the latter substance, says, "From these experiments it is clear that even the most powerful antiseptics are far from being well fitted for removing putrid smells." In the table, as originally printed in the official Report, the above note was preceded by one stating that "McDougall's

Powder gave a distillate so very alkaline, from ammonia set free, that acid was added at once, otherwise the permanganate could not have been tried;" but this has been suppressed in the reprint.

The latter mention of permanganate does not refer to the above trial of Condy's Fluid, but to the use of this substance as the agent by means of which the results of the experiments were judged of. It was made by Dr. Smith, and very properly so, the supreme criterion of the efficacy of all other substances. It might have occurred to him, we think, that the body which was so well suited, in its character of sovereign arbiter, for declaring the shortcomings of other disinfectants, was itself, on account of that very circumstance, the most powerful disinfectant; for its efficacy in the former capacity depends on its possessing exactly the same potency which would render it superior to all as a disinfecting agent,—namely, that derived from the active oxygen which it contains.

In the deodorizing experiments summarized in the three tables above alluded to, the results were, of course, judged of only by the sense of smell. But with carbolic acid and other such strong-smelling substances, it is utterly impossible to determine whether the effect produced be not that of merely masking a disagreeable odour; whereas, with non-odorous disinfecting agents, such, for instance, as Condy's Fluid, no difficulty of this kind can arise. A simple experiment which has been several times mentioned of late in the French medical journals, shows how deceptive are the pretended deodorizing powers of carbolic acid. Foul bilge-water, after treatment with that substance till the stench was well masked, was found to blacken silver plunged into the mixture quite as rapidly as the bilge-water which had received no carbolic acid, thus clearly proving that free sulphuretted hydrogen was still present, notwithstanding that its odour had been disguised by the smell proper to the so-called deodorizer.

Since the time when Pasteur first enunciated his infusorial theory of fermentation and putrefaction, it has become the fashion with many persons, and with none more so than those who have an interest in popularizing the tar acids as disinfectants, to produce him

as a witness in favour of what is called the germ theory of zymotic diseases. So long as those diseases were all but universally considered to be due to subtle changes in the constitution of the blood more or less analogous to catalysis or chemical fermentation, and to reproduce themselves by means of morbid blood-products possessing the power to communicate their own peculiar state to sound blood, it was difficult to explain the action on infective matter of carbolic acid, which is known to be incapable of arresting catalytic transformations and of neutralizing the products of morbid processes. But so soon as the supposition was started in a plausible form that the zymotic diseases have their origin in living animalcules or their germs, there was room to argue, with some show of reason, that a substance of a nature so inimical to infusorial life as carbolic acid is reputed to be, must of necessity be admirably qualified to destroy, after the manner of a poison, the vitality of organised disease germs. Dr. Smith, in this respect, is not far behind the host of more vulgar adherents of the germ doctrine, which from the time of Kircher and the pathologists of the 17th century has maintained a certain hold on the popular mind. It will be seen by the following extracts from our author that he distinctly puts forward Pasteur as the originator or perhaps rather the reviver of a germ or animacule theory of disease, and speaks of him as having written on the subject of contagion in opposition to Liebig.

"The results obtained by M. Pasteur regarding the existence of organized substances, as we may call them, or germs, is a step so definite, clear, and important, that we must at once begin as on a new foundation, and date theories of many diseases, and also of disinfection and cure from this era (p. 18). . . .

"If we examine previous inquiries into the compounds, resulting from the decomposition of organic substances, we shall find nothing which is at all calculated to bring out such an intelligent and rational view of the origin of many diseases, and also of some phases of putrefaction [as those of Pasteur]. Chemists, when they have examined products of the latter action, have found sulphuretted hydrogen, hydrogen, carbonic acid, nitrogen, ammonia, acetic acid, lactic acid, butyric acid, and numerous uncertain bodies,

[all] having no activity and utterly incapable of producing those prodigious results which are found when that force begins to work which produces small-pox or black death (p.p. 21, 22). . . .

"Is the cause of [those] diseases an organic substance in the process of decomposition conveying that decomposition to another body, or is it an organized germ? The two great theories may be called Liebig's and Pasteur's; the first, Liebig's, dealing with organic decomposing matter, ready to communicate its action by its activity. The second, that of Pasteur, leads to organized bodies or germs, and although he has not first originated the idea, the clearest proof and expression of it is due to him. (p. 22). . . These explanations may be called two, the chemical and the germ theory (Liebig's and Pasteur's). There seems no reason to limit the number of infectious diseases till the number of chemical substances transferring decomposition is limited also, and until the number of germs, and the list of their transformations, is finally completed and made known to us." (p.p. 28, 29).

Now, we are quite unable to remember any writing by Pasteur, in which he treats of the intimate nature and cause of contagious or any other diseases, whereas Liebig, as is well known, has devoted one of the most interesting chapters of his "Chemistry of Agriculture" to the discussion of those subjects. Pasteur, indeed, has written, and written well, on fermentation and putrefaction, as Liebig also has done; but their views on the latter questions, though divergent, are not so entirely in opposition as has been generally supposed. Their several investigations led them in different directions,—that of the latter, towards oxidation or the more purely chemical phase of the fermentative and putrefactive processes,—that of the former, to the part played by infusoria. But while Pasteur admits, that flesh protected from infusorial germs is capable of gradually acquiring taint when in small volume, and of becoming "gangrenous" when in larger masses, Liebig has, to a certain extent, forestalled Pasteur by recognizing the active agency of infusoria in the processes by means of which organized tissues are broken up and reduced to simple binary compounds. Both are agreed in respect to fermentation and putrefaction being ultimately effected by chemical means, only Pasteur has

perhaps underestimated the activity of atmospheric oxygen when unaided by the presence of infusoria and exaggerated the influence exerted by the latter organisms. Let him and Liebig speak for themselves.

"La combustion lente des matières organiques après la mort," writes the former, "quoique réelle, est à peine sensible, lorsque l'air est privé des germes des organismes inférieurs. Elle devient rapide, considérable, sans comparaison avec ce qu'elle est dans le premier cas, si les matières organiques peuvent se couvrir de mucédinées, de mucors, de bactéries, de monades. Ces petits êtres sont des agents de combustion dont l'energie, variable avec leur nature spécifique, est quelquefois extraordinaire, témoin l'exemple saisissant do la combustion de l'alcool, de l'acide acétique, du sucre, par les mycodermes que j'ai fait connaître il y a une année à l'Académie."—(*Examen du rôle attribué au gaz oxygène atmosphérique dans la destruction des matières animales et végétales après la mort;* par M. L. PASTEUR: Comptes Rendus de l'Académie des Sciences, t. lvi., p. 738.)

"Si les êtres microscopiques disparaissaient de notre globe, la surface de la terre serait encombrée de matière organique morte et de cadavres de tout genre (animaux et vegetaux). Ce sont eux principalement qui donnent à l'oxygène ses propriétés comburantes. Sans eux, la vie deviendrait impossible, parce que l'œuvre de la mort serait incomplète.

"Après la mort la vie reparaît sous une autre forme et avec des propriétés nouvelles. Les germes, partout répandus, des êtres microscopiques commencent leurs évolutions, et à leur aide et par l'étrange faculté qui fait l'objet de ce memoire, l'oxygène se fixo en masses énormes sur les substances organiques que ces êtres ont envahies et en opère peu à peu la combustion complète.

"Qu'il me soit permis, en terminant cette trop rapide exposition, de caractériser brièvement à un autre point de vue les resultats de ce travail. Nous venons d'apprendre qu'il existe des cellules organisées qui ont la proprieté de transporter l'oxygène de l'air sur toutes les matières organiques, les brûlant complétement avec un grand dégagement de chaleur ou les arrétant à des termes de compositions variables. C'est l'image fidèlo de la respiration et de la combustion qui en est la suite, sous l'action de ces globules organisés que le sang apporte sans cesse dans les cellules pulmonaires, où ils viennent chercher l'oxygène de l'air pour le répandre ensuite dans toutes les parties du

corps, afin d'y bruler à des degrés divers les principes de l'économie."—(*Etudes sur les mycodermes: Rôle de ces plantes dans la fermentation acétique ; par* M. L. PASTEUR: Comptes Rendus de l'Académie des Sciences, t. liv., pp. 269, 270.)

In all this, however, which is the language of a real chemist and not of a mere microscopist, as Pasteur is very often by misrepresentation made to appear, there is nothing about the germ origin of disease. His name is not connected, in any paper of his which has come before us, with the theory that the entrance of a variety of animalcules into the blood is the cause of specific diseases. On the contrary it is connected in the published proceedings of the *Academie des Sciences* with an occasion, when, being called on to pronounce on the blood of a rabbit, dead from putrid carbuncle, wherein MM. Jaillard and Leplat thought they had discovered infusoria which were the cause of the disease, Pasteur gave it as his opinion, after due examination, that the blood in question had undergone putrid alteration after its removal from the body (*Comptes Rendus*, t. lxi., page 527).

Now let us hear Liebig:—

"The ultimate products of decay and putrefaction are carbonic acid, ammonia, and water. In order to comprehend the process by which this conversion is effected it is requisite to be acquainted with the intermediate compounds formed by the elements. But so far as the process itself, chemically speaking, is concerned, it is quite indifferent whether or not, before assuming the final state, they take on the form of fungi or infusoria. These plants and animal organisms are not the intimate causes of conversion. They are, on the contrary, simple intermediate means of transforming putrid organized substances. They live upon certain of their elements, and exude excrementitious matter, increase in size to a certain point, die, and then are themselves resolved into the ultimate products of decay."—(*Liebig's Chemistry of Agriculture*, 4th ed., p. 348.)

"It is quite certain that water containing certain living infusoria becomes a source of oxygen gas when exposed to the action of light. It is also certain that as soon as these organisms can be detected in water, the latter ceases to

act injuriously to plants or animals. Now, it is obvious that if we add to such water animal or vegetable matter, in a state of decay, being in contact with oxygen, it will resolve itself into the ultimate products of oxidation in a much shorter time than if infusoria were not present."—*Ibid.*, pp. 352-3.

The controversy, in connection with which Pasteur really did come so prominently before the scientific world, was that relating to the origin of infusorial life, wherein he was opposed by Pouchet. It was considered by the former that he had proved such vital phenomena to be, in all cases, due to the universal prevalence of germs (panspermism), whereas the latter contended that he had demonstrated experimentally that infusoria were capable of originating in circumstances where the access of germs from without was impossible, and that their appearance might be explained by the coalescence of molecular organic matter under the influence of certain physical conditions (heterogenesis or spontaneous generation). Dr. Angus Smith seems to be under the erroneous impression that the antagonism between the views of Pasteur and Pouchet on this question had given rise to the promulgation by the former of opinions on the intimate cause of contagion, in opposition to those of Liebig. This impression probably had its source in confounding the labours of Pasteur with the utterances of Lemaire, a writer on the merits of carbolic acid, and a very different kind of authority, according to which vibrionic animalcules of various species found by him in the air of hospitals are the causes of such diseases as small-pox, scarlet fever, measles, typhus, &c., which, if it were so, would render it a matter of wonder how any hospital patient could ever come out alive from such institutions. That the various fungi described by Thomé, Klob, and Hallier as the cause of cholera and the infusorial monads, bacteria, vibriones, &c., to which Lemaire and others attribute typhus, dysentery, yellow fever, hospital gangrene, &c., are rather attendants on the morbid impurity which is associated with those diseases than the primary causes of them might have suggested itself, we

think, to the latter gentleman, from one of the experiments which he himself has related. Having allowed his mouth, it seems, to get into a foul state by refraining from bucal ablution during a week, he examined the secretions under a microscope and found them to contain monads, bacteria, and even vibriones in great abundance. His health, notwithstanding, wonderful to relate, remained good, and not the smallest threatening of any of the ailments of which, according to him, those organisms are the causes, ensued! The results of Lemaire's experiments on the air of hospitals have been verified by Mr. E. Lund, of Manchester; but, so far as we know, without his subscribing, in consequence, to the disease theories of that observer. The conclusion to which he came simply was, that the presence of infusoria, such as actively moving vorticellæ and monads in the atmosphere, was one of its common conditions. The Rev. M. J. Berkeley, who is one of the most experienced of mycologists, has, on the other hand, failed to detect such organisms in diphtheritic membrane, although that product, being a mass of morbid matter of the most virulent kind, was exactly the situation in which they ought to have been most readily discovered.

The crude theories of Lemaire have even been surpassed by what is called the fungus theory of disease, on which the *British Medical Journal* recently made the following telling remarks :—

"Mr. Erasmus Wilson watches with amazed curiosity the progress of the fungus theory. It began, he says, with the dermophytes and nosophytes of Gruby; he disbelieved it; and disbelieves it still, although it has since intruded itself into almost every known disease of the body; at first there was a struggle for the distinction of genera and species, every philosopher had his pet fungus; there was the fungus of Schœnlein, and the fungus of Audouin; a new order of knighthood seemed to have been created throughout Christendom, and every knight in Europe proclaimed his own particular fungus as the loveliest fungus of them all. Then a new school of philosophers declared that the difference amongst the various fungi was only a difference of their habitat, and that the same fungus transplanted to different

beds exhibited those differences which unobservant or too acutely observant philosophers mistook for other species. Then, when the outside man was exhausted, the inside man came in with its discoveries: there were fungi for aphthæ, fungi for diphtheria, fungi for cholera; and, last and not least, we have fungi for internal cysts, fungi for syphilis, and fungi for gonorrhœa. This last absurdity completes the measure. 'Fungi,' says Mr. Wilson, 'are the morbid development of the natural components of the cell-structure of the economy; and just as pus is the product of the nuclei of the cell-tissue; just as mucus is equally a product of the normal constituents of the cells of the epithelium, and, being produced, enjoys the property of proliferation and growth; so these presumed and omnipresent fungi are the gatherers-up of waste and exhausted organic matter, and are ready to be found wherever waste and exhaustion of organization prevail. Twenty years ago we taught the nature and relations of fungous life to all who chose to give heed; twenty years have passed away, and modern science has not come up to the standard which we then established.'"—(*British Medical Journal*, April 4, 1868.)

Irrespective of the absence of all direct proof that the essential material of contagious animal products is composed of independent living organisms, which are not blood-products, there are theoretical considerations to render that hypothesis very difficult reasonably to be entertained. Vaccine lymph, which is one of the best types of this poisonous matter, fails to reveal the presence of any such organisms. Dr. Beale, it is true, has detected in it, by means of the microscope, organized and perhaps vital particles of what he calls "germinal matter;" but these particles are not pretended by him to be independent germs or seeds. On the contrary, his observations and reasoning go to prove that they are blood-products. Notwithstanding this the advocates of the germ theory of disease, by means of a kind of ambiguity not unlike thimble-rig, are in the habit of equivocally using the term germinal matter as synonymous with germ, whenever it suits their purpose. An instance of this sophism occurred some little time ago in a paper read by a medical man, Dr. R. Hamilton, at the Liverpool Medical Institution, "On the use of Carbolic Acid in

Surgery." "The author," to use the words of the report of his essay given in the *British Medical Journal* for April 4, 1868, "first gave a sketch of the *germinal* theory and the supposed influence of carbolic acid in destroying *germs*, which belong to the lowest forms of organic life, &c." But so unsatisfactory is this germ or cell theory felt to be by some of its advocates, that one of the most strenuous of them, Mr. Crookes, has found himself constrained to conjure up an imaginary poisonous excretion of a chemical character, for the purpose of explaining the *modus operandi* of contagion. At page 187 of the Third Report of the Cattle Plague Commission, he says: "It is, therefore, probable that during the multiplication of the virus cells, they impoverish and weaken the blood, by feeding upon some element in it, whilst at the same time they excrete a poison to which the symptoms of the disease may be immediately due."

It can hardly cause surprise that Mr. Crookes, who really is a chemist, should have felt dissatisfied with mere cells or germs as the intimate cause of the cattle plague. By the theory which attributes such affections to poisonous blood-products in peculiar states of transformation, we are enabled satisfactorily to explain, by the gradual oxydation of the virus, the phenomena of spontaneous recovery. But it is hard to see by what means self-propagating living organisms should come to diminish and finally disappear. The process by which the system frees itself from organic poisons has apparently received considerable elucidation from Dr. Rosenthal, of Ulm. He found, from experiment, that artificial respiration was capable of neutralizing poisonous substances when introduced into the system of animals, and drew the conclusion that the respired oxygen had the property of decomposing them and of converting them into innoxious compounds.

The tendency of the strict investigations into the intimate nature of morbid poisons which are now occupying some of our foremost minds, is all in the direction of the discovery of a cause underlying the phenomena of infusorial life. Dr. Thudichum for

instance, has announced that his researches encourage him to think that more light is to be thrown on this question by the spectroscope than by the microscope. The observations of Schmiedeberg and Bergmann are reported to have confirmed in a remarkable manner the prior investigations of Dr. Richardson on the subject of the poisons of the spreading diseases, some of which the latter had succeeded in isolating and recombining with other elements in somewhat the same manner as that in which the vegetable alkaloids are obtained and dealt with. Professor Fischer of Berlin has, more recently, turned his attention to the latter point, and although he has not yet succeeded in obtaining from morbid secretions the active crystalline body described by Bergmann, he states that he has discovered putrefying pus to contain several distinct poisons, some of which can be separated by dialysis through animal membrane. Should the latter observation be confirmed it must, to use the language of the *Lancet*, give the death-blow to the germ-theory of disease.

Some curious phenomena connected with the morbid poisons are alluded to by Dr. Richardson, in his essay "On the Poisons of the spreading Diseases." He has satisfied himself that the bodies of persons suffering, say, from scarlet fever, cease to be infectious very soon after death. Yet it is precisely in dead bodies between the period of death and the supervention of putrefaction that originates the cadaveric infection, known by the name of "dissecting-room poison." Nevertheless, when decomposition has fairly set in, pricks received in dissecting dead bodies are no longer to be much feared. The germ-theory of morbid poisoning is not very consistent with these facts.

It is evidently in consequence of the adoption of the doctrines involved in the latter theory that many of the advocates of disinfection by antiseptics have been in the habit of experimenting on vegetable organisms, such as yeast, or on animalcules, insects, &c., rather than on the products of disease. In the whole of the 24 preliminary experiments detailed by Mr. Crookes, in his Report on Disinfectants to the Cattle Plague Commission, only one had any reference to morbid

virus; and that could not well have been less conclusive. Here is his account of it:—

"The air from a close, highly infected shed, containing animals in the last stage of the disease, was drawn through glass tubes containing tufts of cotton wool. The suction was continued for ten minutes. One piece of the infected wool was then exposed for half an hour to the vapour of carbolic acid. Two apparently healthy calves were selected, and, an incision being made beneath the skin, these pieces of wool were respectively inserted in each. The animal thus inoculated with the infected wool, which had been exposed to carbolic acid, remained perfectly well, but the other animal took the disease and died in a few days. I place this upon record, although I do not attach much importance to it, as the experiment was made at a farm where the plague was raging; and it is quite possible that the calf which died did not take the disease from the wool. Unfortunately time would not permit me to verify this experiment so as to place its results beyond doubt.—*(Third Report of the Cattle Plague Commission, (p.* 193*).*

It was not only extremely unfortunate that time would not permit the verification of this important experiment, but very remarkable that a crucial test of the value of carbolic acid as a safeguard against infection, which may be considered the special business with which he was charged, should have been prevented by want of time from being completely applied, especially considering that so much time had been found for comparatively irrelevant experiments. This is the more worthy of remark that the same unfortunate circumstance caused the experiments on the curative effects of the internal administration of carbolic acid to be cut short at the very time when they were apparently on the point of demonstrating the success of that method of treatment. But just at that critical juncture, "business," says Mr. Crookes, "called me to London, and I was unable to watch the further progress of these cases. This is to be regretted" (p. 200). It is not the first time that "urgent private business" has been made answerable for retirement from unpromising work. As a good deal has been made in certain quarters of the pretended success of these experiments, we give the results obtained,

which show a rate of mortality differing but little, if at all, from the general cattle plague death-rate.*

Nos. by which the cows were distinguished.	Results.
No. 10	Died on 6th day
„ 11	Died on 6th day
„ 12	Died on 6th day
„ 13	Killed by first injection of carbolic acid
„ 14	Slowly recovered.

In his account of Mr. Crookes' experiments Dr. Smith has neglected to mention those which went to show that carbolic acid is destitute of power to control the decomposition of nitrogenous compounds. He states fully enough, in short, all the positive results, such as the arresting of the fermentation caused by yeast, and the destruction of infusoria, cheese-mites, beetles, caterpillars, and fish, but makes no allusion to the negative results obtained from the addition of carbolic acid to solutions of diastase and amygdalin. He cites (p. 62), it is true, Professor Pettenkofer's statement that "carbolic acid preserves, in an inert state, ferment cells, but that when that substance has become dissipated they become again active," adding, however, "*If this be true*, the disinfectant [carbolic acid] must be used continuously, and the impure matter must be cleared away continuously, whilst soon in time and especially in the earth (*sic*) the infectious matter will die. We must put it out of the position where it will be dangerous. It is difficult to use enough of any disinfectant, to destroy poison where life must be preserved, and impossible to do so instantly where the poison is strong." What a muddle! The difficulty here conjured up is one that is not felt when destructive disinfectants are used, although it must undoubtedly

* Within the last two or three years, carbolic acid has been extensively used in surgery; but the results, when tested by facts and figures, on the large scale, are very far from satisfactory. According to a correspondent of the MEDICAL TIMES AND GAZETTE (March 20, 1869), who derived his information from the official case-books of the hospital, the rate of mortality from amputations and compound fractures in the wards of the Glasgow Infirmary, which are the head-quarters of the "antiseptic plan," has considerably increased since the introduction of dressings of carbolic acid.

occasion much embarrassment when preserving antiseptics are employed. What Dr. Smith has intended to insinuate is that chlorine cannot be used among cattle in sufficient quantity to destroy morbid products without inconvenience to the beasts and their attendants. But this is a mere conjecture on his part. Professor Stone, who actually used chlorine so largely in Lancashire during the cattle plague, has quite another tale to tell. If, even, it were necessary to discard chlorine on account of its irritating effects on men and animals, there are other disinfectants of the destructive class which are free from this objection. Condy's Fluid, which acts by the agency of oxygen, is quite as destructive (if not more so) to morbid matter as chlorine, without causing any inconvenience whatever to living beings.

The doubt which our author appears to have of the truth of Pettenkofer's statement respecting the powerlessness of carbolic acid effectually to neutralize ferment cells, would, in all probability, have been set at rest, if he had chosen to make himself acquainted with Dr. Richardson's researches. In his treatise on the poisons of the spreading diseases (p. 15), this able and original observer says:—"The poison of hospital fever, which would undergo decomposition if left alone, I have been able to preserve for months. Sulphur, creasote (the analogue of carbolic acid), and arsenic, hold these organic poisons in perfect steadiness, so that they undergo no change, but preserve their active properties." But Dr. Smith has evidently not intended his treatise to be the means of fully enlightening the public on the philosophy and practice of disinfection, but instead to afford as complete a view as possible of all that can be said in recommendation of the antiseptic substances which enter into the powder of his invention, with just sufficient accompaniment of common-place, but occasionally more or less favourable, observations about other substances, to give the appearance, to the uninitiated, of his having treated the subject in an exhaustive and independent manner. Those unacquainted with the way in which the disinfectant question has become mixed up with personal rivalries, may, perhaps, at first-sight, consider this judgment unfair; but, on looking narrowly at

the history of Dr. Smith's connection with the Cattle Plague Commission and the results (so far as disinfectants were concerned), as these are to be gathered from the published Reports, they will have little difficulty in admitting that it is not inconsistent with many of the circumstances therein revealed.

The First Report of the Cattle Plague Commission, dated 31st Oct., 1865, has the following:—

"Chloride of lime, carbolic acid, or *the powder* containing carbolate of lime and sulphite of lime should be used. The latter is probably the best; it contains a well-known disinfecting substance which is formed when sulphur is burnt, and also a strong antiseptic material—creasote from coal-tar."—(p. xxiii.)

In the Second Report, dated 5th Feb., 1866, we read as follows:—

"The experiments on disinfection and ventilation have been committed, under the general superintendence of the medical and scientific members of the Commission, to R. Angus Smith, Esq., Ph.D. . . . .

"The experiments of Dr. Angus Smith show that the best disinfectants are carbolic acid (or McDougall's Powder) and chloride of lime. . . . . For washing purposes, Dr. Angus Smith recommends McDougall's Disinfecting Soap, which contains crude carbolic acid."—(pp. viii., ix.)

In the Third Report, dated 1st May, 1866, we read thus:—

"In our Second Report we stated that we had requested several gentlemen, eminent in medicine and chemistry, to investigate the cattle-plague from some special points of view. . . .

"Disinfection, in the sense in which the word is here used, implies the destruction of an animal poison, in whatever way it is accomplished. To find a perfect disinfectant for the cattle-plague poison, would be to stop the disease at once. We have naturally been very desirous of discovering a substance with such a power; but much more evidence is necessary before we can venture to affirm that success has been obtained. In the first instance we requested Dr. Angus Smith to undertake this subject, with the view of seeing what chemical agent would be best suited for the purpose. Subsequently, *at his suggestion*, Mr. Crookes was asked to carry on various practical trials

which might test the efficacy of TWO agents, which Dr. Angus Smith had reported to us as likely to be useful." (p.p. III, VIII, IX).

These passages, which begin (Oct. 31, 1865) with "the Powder," and end (May 1, 1866), with its TWO active ingredients, reveal the presence, in the bosom of the Commission, of an ardent admirer and staunch friend of Dr. Smith, who seems to have well performed the part of *Deus ex machinâ*. Who he was there is no evidence before us to show; but there are persons, we believe, who think themselves "far enough north," as the Scotch have it, to make out the colour of his tartan.* As for Mr. Crookes, to outside spectators he seems to cut the figure of the "fifth wheel to a coach;" but, doubtless, some of the riders in the official vehicle had reasons for desiring to present the appearance of extra solidity. Severe strictures on the proceedings of the Commission relative to disinfectants, ending in certain somewhat embarrassing questions which were put in the House of Commons, had for some time been in circulation. It is just possible that the intervention of Mr. Crookes was not unconnected therewith. The manner in which his part was performed may be left for himself to tell, in the following passage from his Report :—

"Dr. Angus Smith, by his exhaustive examination of disinfectants, has rendered it unnecessary for me to search among the numerous class of possibly useful bodies, for those likely to be of practical value. His results I accept in the full conviction that they are correct; and *I proceed to investigate* the respective merits of the comparatively small number of agents available for disinfection. . . . . The choice is, therefore, limited to the oxydizing disinfectants—chlorine and ozone, and the antiseptics—sulphurous and the tar acids. These are representative bodies, and *numerous trials* have been made with them before coming to a conclusion as to their respective merits; the results

* A writer in the FIELD under the somewhat significant signature of "Fair Play," pointedly observed at the time, in reference to this matter: "The cause of all this was evidently the appointment of Dr. Angus Smith. A man with a simple hobby would have been bad enough, but one with a patent was, beyond all others, to be avoided. How, it may be asked, came it that Professor Playfair did not enlighten his fellow commissioners respecting Dr. Smith's position of patentee, of which he must have been well aware?"

being embodied in the following pages. I am bound to admit that the conclusion to which I have been forced to come is quite opposed to my preconceived ideas on the subject. I started with a strong bias in favour of chlorine and ozone, but the irresistible force of the arguments derived from my *experiments* has caused me to alter my opinions."—(*Third Report of the Cattle Plague Commission* pp. 188, 189.)

In the latter of the passages just cited, Mr. Crookes has evidently intended to convey the idea of his having *proceeded to investigate* two oxydizing and two antiseptic disinfectants—FOUR in all—and after testing each of them equally or nearly so, by *numerous trials and experiments*, chosen from among them that which best stood the tests to which they had been subjected. But the Commission, or their secretary, has unwittingly let out the truth, and made it clear that Mr. Crookes really experimented on only two—"two agents which Dr. Angus Smith had reported to us to be useful." This accounts for its being shown by his own Report that he rejected ozone on theorectical grounds alone, and without instituting any experiments at all with it (p. 190), and that he performed one, and one only, laboratory experiment, with chlorine, on cheese-mites (p. 189). The distinct statement of the Commission on this point, and the circumstance that Mr. Crookes was not satisfied with the discovery of the one best agent, but must needs declare in favour of both the ingredients of McDougall's Powder, leave no room for doubt that his pretended practical investigation into the merits of four substances, and the allusion made by him to "arguments derived from his experiments," as having forced him to change his opinion about the merits of chlorine and ozone, constitute a case strongly suggestive of the use of the words *credat Judæus*.

Even the solitary experiment with chlorine, instead of telling against that valuable disinfectant, when properly interpreted, speaks loudly in its favour. Here is the official account of it:—

"Cheese-mites were put into water mixed with strongly smelling [and of course more or less putrefying] cheese and sulphuretted hydrogen. Aqueous solution of chlorine was gradually dropped into the mixture from a burette. The

smell of sulphuretted hydrogen was the first to go, then some smell of cheese, but it required a considerable quantity of chlorine to kill the mites. Exactly the same experiment was now repeated, only leaving out the sulphuretted hydrogen and cheese. The chlorine now had nothing to divert its energy from the cheese-mites, which were consequently killed before one fourth of the quantity of chlorine used in the first instance had been added."—(*Third Report*, p. 189).

For purely theoretical reasons, which would hardly suggest themselves to anyone but a partisan of antiseptic disinfection, Mr. Crookes starts with the assumption that the *sine quâ non* in a disinfecting agent must be the possession of the property of killing living organisms, even though unaccompanied with the power of removing the "stinking gases of decomposition," which nevertheless often are the vehicles that, as it were, give wings to contagious particles. He finds that chlorine does kill the mites which in his experiment represented the organized cells supposed by him hypothetically to constitute the basis of contagious virus, but nevertheless rejects that agent, because, at an earlier stage of the experiment, and consequently with a smaller amount of material, it had also destroyed the offensive *nidus* in which the mites had their congenial nutriment, in order to give the preference to one that would (as he thinks) more readily kill the mites, but leave untouched the foul nidus. If, however, he had carried the observation a stage further, he would have seen that after the destruction of the nidus the mites themselves would have died of inanition aud disappeared. It so happens, moreover, in this very case, that the cheese-mites are merely the scavengers that pick up and remove the putrid matter which otherwise would unduly accumulate. Carbolic acid, unlike chlorine, kills the scavengers, but leaves the dirt!

We are very far from saying that it was not competent for the Cattle Plague Commission, relying upon the special knowledge of their medical and chemical members, to decide for themselves the question of the choice of disinfectants; but we will say and uphold that having, instead of so doing, publicly announced that the subject required further

investigation, it was their duty, in selecting the person to conduct the inquiry, to see that the individual chosen was not only fully competent but in no way biassed by having been mixed up with the rivalries of inventors and manufacturers. And we will further boldly assert that in the entire range of British scientific chemists they could not have singled out one more disqualified on the latter grounds than Dr. Angus Smith. That gentleman, however, having once been appointed and having thought himself justified in accepting the trust, could hardly, without belying his whole past career, do otherwise than recommend his own invention. But he ought to have done so in a straightforward and high-handed manner, and not condescended to make a pretence of being guided by fresh investigations, which in reality, as the Reports of the Commision show, had no influence on his conduct nor on their proceedings. It was still less worthy of the Commission, after having allowed themselves privately to give in their adhesion to disinfection by Dr. Smith's invention, to shuffle off their responsibility by permitting the empty forms of a futile investigation to be gone through.*

Before concluding we owe it to ourselves to state that we are behind none in our sincere recognition of the great value of carbolic acid in its true character of antiseptic. It is our firm conviction that, with exception, perhaps, of chloride of zinc solution (Burnett's Fluid), no substance possesses in a higher degree the power of preserving organic matter from decay. Kept in its proper sphere and used for purposes for which it is truly calculated, it is a most valuable sanitary agent. When added in sufficiently large quantity to fresh excrement or stable dung, it

* Well might the Metropolitan Cow Keepers, in their petition to Parliament, of 20th May, 1866, say:—"That your Petitioners being of opinion from a consideration of the above circumstances, that the Cattle Plague Commission have treated in an inadequate and unsatisfactory manner that part of the trust confided to them relative to disinfectants, and being at the same time deeply impressed with the vast importance of proper disinfecting measures, humbly pray that your Honourable House would in your wisdom order a full and impartial inquiry by chemists of the first rank, and other competent but unprejudiced persons, on the subject of disinfection, in order that the public by their unbiassed conclusions, may be saved the loss and disappointment which cannot fail to result from agents which are inefficient, illusory, and dangerous."

effectually prevents decomposition and its attendant evils. In the same way, fresh hides, guts, horns, &c., can be preserved in a comparatively inoffensive state. But there is no use, but the very contrary, in disguising the fact that to be of much advantage it must, as Professor Parkes has shown, be employed largely, and when this is done the operation is by no means inexpensive. It is also useless, nay, extremely mischievous, to foster the delusion that, because carbolic acid has the property of preventing the putrefaction of excrement, it must consequently have the power, in the proportions in which it is generally directed to be used, to neutralize the morbid products on which contagion depends. We believe, however, that the last-mentioned matters, as they exist, for instance, in cholera stools, are destroyed, or, at least, rendered innoxious, by large quantities of this substance. But those who fancy that the mere vapour which is exhaled into the air from cold carbolic acid is capable of exerting any appreciable action on solid morbid particles that may, in certain circumstances, be floating in the air, are certainly labouring under a dangerous delusion; and those who pretend that this result is obtained from the carbolic acid emanations, which proceed from inert powders impregnated with that material, are propagators of a still worse delusion. We would recommend the former (the latter are beyond the reach of argument) to ascertain for themselves what happens to a fish, for instance, when exposed at the usual temperature of the air in a room with a vessel containing undiluted carbolic acid. Putrefaction will be found to be the inevitable result. In the curing of certain kinds of fish by means of creasote (carbolic acid's analogue), very prolonged exposure at a high temperature in close chambers is requisite, and, even under those circumstances, the fish must be untainted to begin with.

The following so-called invention, which has just been announced, is one of the latest instances of this delusion:—"Pagliari, an Italian chemist, has invented a kind of paper, wherein carbolic acid is so thoroughly incorporated that the paper, when used to pack animal substances therein, preserves the same in a fresh state, without salt or any curing whatever." It is

just possible that a very thin slice of meat, when enveloped in this carbolized paper, might be preserved from rapid decay, but to expect that any considerable volume of flesh could be kept from becoming tainted by being so wrapped up, would be downright folly.

After what we have said, our readers will not be surprised to learn that we cannot coincide with the opinion expressed a few weeks ago by our able contemporary, the *Chemical News*, respecting the merits of Dr. Smith's work on Disinfectants and Disinfection. We are not able conscientiously to say with that journal that "almost every page contains evidence of exhaustive laborious research, guided in its course by the clearest judgment. We seek in vain for some weak point to give us occasion to air our critical acumen;" for we imagine that we have brought to the knowledge of *our* readers more than one weak point. Nor can we be expected to agree with our *confrère*, that "no man living is competent to criticise Dr. Angus Smith on disinfection but Dr. Angus Smith himself." But this we will say, that if Dr. Smith were to come forward in the capacity of his own reviewer, he would give a very different account of himself from that which we have been obliged to exhibit.

The upshot of all Dr. Smith's labours and writings is, that, if we were to take him for our guide, we should find ourselves in the matter of the practice of disinfection almost exactly where the ancients were some two or three thousand years ago. Sulphur and tar fumes, as he points ont, were the disinfectants of the Egyptians, Greeks, and other peoples of antiquity. Even savages, it appears, are well acquainted with their properties. And with tar fumes in the more refined state of the "tar acids," and sulphur fumes shut up in union with lime, he would have us rest satisfied, as if Scheele had never discovered chlorine nor Schönbein ozone. These two discoveries are, however, among the glories of modern chemistry, and only second to them is the discovery of the disinfecting properties of those substances. Another hardly less glorious result of modern chemical research, is the elucidation of the processes of fermentation and

putrefaction, with which Liebig's name is so indissolubly connected, and the unravelling of the part played therein by oxygen, by means of which we have been enabled to understand the several modes of action of destructive disinfectants and preserving antiseptics. To seek to obscure those important subjects and propagate the doctrine that in the practice of disinfection the distinction between disinfectants proper and antiseptics is of no utility is to retrograde to the dark ages. This, nevertheless, is the tendency of Dr. Angus Smith's treatise on disinfectants and disinfection, the chief object of which, as of his previous writings, seems to be to confuse that which the labours of many eminent men had succeeded in putting into an intelligible and satisfactory shape, and all, apparently, for the mere honour and glory of advancing the credit of a compound, of the imperfections of which no better evidence is required than that which is furnished by the contents of the Cattle Plague Reports. That he has not laboured in vain, will be manifest from the following *resumé* of the teachings of his book which recently appeared in the columns of a talented contemporary, and from which it would seem that Dr. Smith is considered to have brought the art of disinfection to consist in the practice of graduated poisoning:—"Dr. Angus Smith points out, in his new work on *Disinfection*, that all disinfectants have this in common—that they destroy living things. It is so with chloride of lime, with permanganate of potash (Condy's fluid), with carbolic acid, each of which kills in its own peculiar way. The use of disinfectants for sanitary purposes depends on the superior vitality of the higher animals; and the practical management of disinfectants consists in securing a sufficient degree of action to destroy noxious matter, without at the same time injuring the higher animal."

Unfortunately for the higher animal, however, carbolic acid and some other deleterious substances, when placed in the hands of the general public, who are no adepts in graduated poisoning, are by no means free from serious risk to life. Between the months of February 1868 and March 1869 no fewer than eight fatal accidents from carbolic acid have been recorded. While such is the fact with regard to this so-called

non-destructive antiseptic, not a single death that we can remember has ever been attributed to the destructive oxidizing disinfectants such as chlorine and Condy's Fluid. The truth is that oxidizing substances, though eminently destructive to decaying and putrid matters, are comparatively devoid of violent action on the living tissues. This discriminating quality is, in our opinion, an important requisite in disinfectants. But it has nothing in common with graduated poisoning, which, in theory as in practice, is more worthy of the craft of the Red Indian medicine-man than of European science in the nineteenth century.